

The main goal of the project is to develop methods for faster resolution of optimization problems, i.e. finding approximate solutions for various types of difficult tasks that cannot be solved exactly in the finite time. These types of tasks occur all around, and the inability to obtain good solutions for them causes measurable losses. These are, for example, tasks such as managing urban traffic using traffic lights, planning salesman movement or cutting material into elements of given dimensions.

Improving the efficiency of methods for solving this type of problems will be based on the use of High Performance Computing (HPC) systems that provide very high computing power by providing access to hundreds or thousands of connected computers. These types of systems are made available on demand for specific calculations - they are shared by many users.

Because HPC systems are not individual computers, it is necessary to adapt the software accordingly. Programs that calculate rough solutions to difficult tasks must be able to use multiple computers at the same time. There are already solutions that can effectively use several or several dozen computers, but effective use of several hundred or several thousand machines is currently not possible. Developing methods to solve this problem is the main goal of the project.

An indispensable aspect of calculations carried out in the HPC environment is state synchronization, which can not be completely avoided (from time to time the elements of the system must communicate with each other, which reduces the scalability and thus the efficiency of infrastructure use). During state synchronization, it is necessary to pay attention to the time of sending and receiving messages mutually updating information of individual parts of the calculation. However, it turns out that in the case of metaheuristics this type of restriction can be relaxed, we can allow some messages to arrive later (or too early) to individual parts of the calculation, we can even allow them to be lost (if allowed by the technologies used). According to the beliefs of the authors of the application, desynchronization of status updates will allow achieving greater scalability and efficiency in the use of HPC infrastructure, and research on this type of mechanism together with extensive experimental and verification plans are the subject of this application.